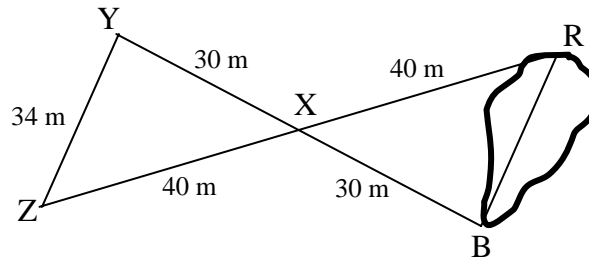


## Applications

1. A Forest Ranger needs to measure the distance across a pond from point R to point B. She knows the measures between the points shown below.

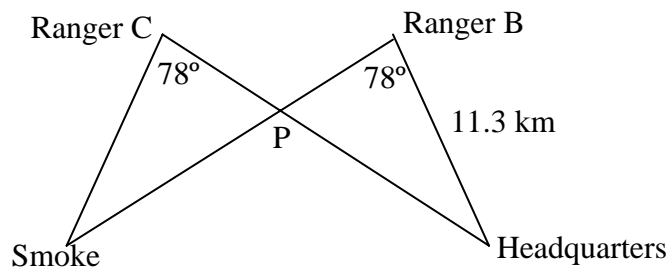


Note: The figure is not drawn to scale.

Describe how the measurements shown enable her to determine the distance across the pond.

What is the distance from R to B? Use mathematics to justify your answer.

2. Ranger B and her assistant, Ranger C, each sight a puff of smoke from two different ranger stations in the park. The smoke is located as shown, and point P is equidistant from the two rangers.

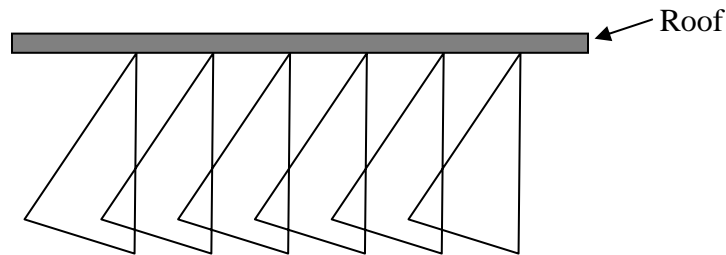


Note: The figure is not drawn to scale.

How close is Ranger C to the smoke? Use mathematics to justify your answer.

### Applications (Continued)

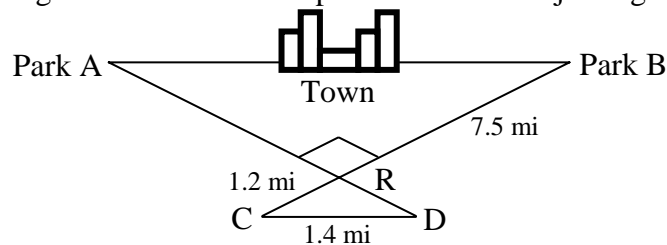
3. In the roof shown below, the triangles that support the roof must be congruent.



Note: The figure is not drawn to scale.

How can you prove to your boss that the triangles are congruent without measuring any angles?

4. Mason Construction wants to connect two parks on opposite sides of town with a road. Surveyors have laid out the map as shown. The road can be built through the town or around the town through point R. The roads intersect at a right angle at point R. The line joining Park A to Park B is parallel to the line joining C and D.



Note: The figure is not drawn to scale.

- Determine the distance between the parks through the town. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.
- Determine the distance from Park A to Park B through Point R. Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.
- If it costs \$3.5 million per mile to build the road around the town and \$6.5 million to build the road through the town, which road would be cheaper to build? Use mathematics to justify your answer.

## Applications (Continued)

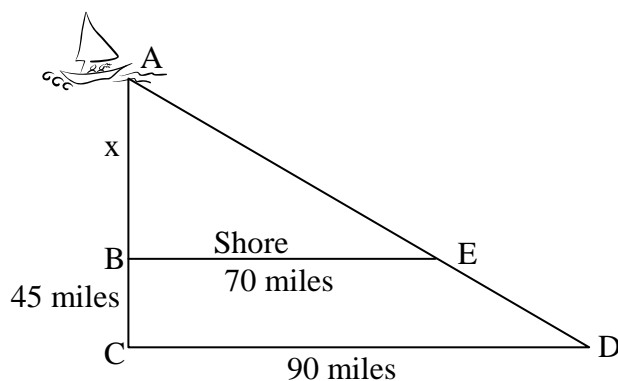
5. Marni wants to know the height of the climbing wall in the park. As she is standing next to the wall, Marni measures her shadow and the wall's shadow.



Note: The figure is not drawn to scale.

Determine the height of the wall if Marni is 170 cm tall.

6. Captain Cook needs to know the distance from his ship to the shore. He knows the measures given and that  $\overline{BE} \parallel \overline{CD}$ .

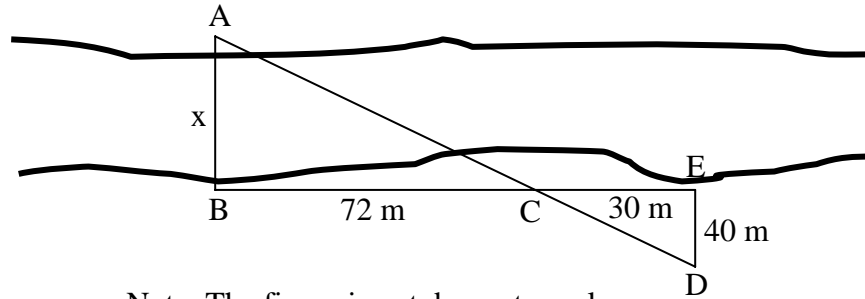


Note: The figure is not drawn to scale.

What is the distance ( $x$ ) from his ship to the shore? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

## Applications (Continued)

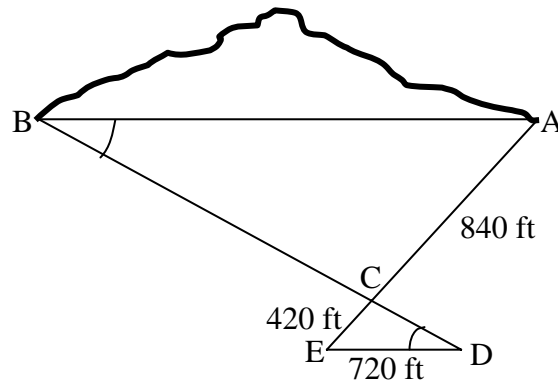
7. In the military it is often necessary to build temporary bridges across a river. To do this, it is necessary to determine the distance across the river. Sighting an object across the river, the engineer will set up right triangles to measure the distance across the river indirectly.



Note: The figure is not drawn to scale.

Using the diagram above, what is the length ( $x$ ) of the bridge? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

8. A surveyor needs to determine the distance across the base ( $AB$ ) of a mountain. This surveyor can directly measure the lengths given below.



Note: The figure is not drawn to scale.

- Is  $\triangle EDC$  similar to  $\triangle ABC$ ? Use mathematics to justify your answer.
- What is the measure of the base ( $AB$ ) of the mountain?

- Answers:
1. The measurements shown can determine the distance because there is enough information to show that the triangles are congruent because of side-angle-side triangle congruence. The distance across the pond is 34 meters.
  2. The triangles are congruent by angle-side-angle triangle congruence, so Ranger C is 11.3 km from the fire.
  3. All of the triangles can be proved to be the same size by measuring all of the sides of each triangle (side-side-side triangle congruence).
  4. The two triangles are similar by angle-angle triangle similarity.  

$$\frac{1.2}{7.5} = \frac{1.4}{AB}$$
 so that  $AB = 8.75$  miles  
 The length of  $\overline{AR}$ , by the Pythagorean Theorem, is about 4.5 miles, so the distance between the towns through R is  $4.5 + 7.5$ , or 12, miles. The cost of the projects would be \$42 million (12 miles  $\times$  \$3.5 million per mile) around town or \$56.875 million (8.75 miles  $\times$  \$6.5 million per mile) through town. It is cheaper to build the road around the town through point R.
  5.  $\frac{170}{310} = \frac{x}{840}$  so that  $x = 460.64$  cm.  
 The wall is approximately 461 cm tall.
  6. The triangles are similar by of angle-angle similarity. So,  

$$\frac{x}{x + 45} = \frac{70}{90}$$
 so that  $x = 157.5$  miles
  7.  $\frac{30}{72} = \frac{40}{x}$  so  $x = 96$  meters
  8. The triangles are similar by the angle-angle similarity theorem (using the given angles and that vertical angles are congruent).  
 $AB$  is  $\frac{420}{840} = \frac{720}{x}$ , or 1440 feet.